INTEGRATING SPHERE AND HEMISPHERE CALIBRATION UPDATE

by

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BACKGROUND:

This background information relates to the conclusions reached about the GSFC/Optronic calibrations for the 6-foot sphere. The history of these calibrations date back to the year 1978 when Optronic first calibrated this sphere. The comparison of the data taken then indicated rather close agreement between the measurements taken by GSFC and Optronic Labs. This trend continued in 1979 and in 1982. The sphere was refurbished in terms of repainting and changing the lamps in the Spring of 1985. As a result of the refurbishing, the output radiance of the sphere nearly doubled going from about 80 to 140 in relative numbers as reflected in data taken by both Optronic and GSFC.

This high output seems to have an effect on the values we measure. A comparison of data taken by Optronic and GSFC show differences of 12 to 15 percent rather than the 2 to 3 percent that we had seen in past measurements. The reasons for the differences are not clear. While Optronic has changed their calibration equipment and methods somewhat, the changes are the types that should tend to improve the measurement. Although the GSFC measurement procedure has not changed, the personnel performing the measurement has changed, and the results seem to be reasonably consistent with previous measurements.

RECENT DEVELOPMENTS:

Both the hemispherical and the spherical integrating sources were remeasured in February 1988 by two experimenters and the results show a decrease in the output of the sphere. But the discrepancy between GSFC data and Optronic Data remains. The decrease in the output can be accounted for by a correction in the current value of power supplies Number 2 and Number 3. The supplies were running about 1.75% high. Minor differences were noted in the short wavelength end of the hemisphere.

The data represents a composite of the average of all the data taken by the different detectors, namely, silicon, germanium, lead sulfide; different spectrometers, and different operators. The estimated uncertainty in the precision of our measurement is +/- 3%. However, the uncertainty in absolute accuracy is estimated to be somewhat higher, probably 5% to 10%.

Efforts to resolve the discrepancy between GSFC and Optronic Labs as well as improve our ability to make more accurate and precise measurements are underway. Arrangements are being made for a meeting between GSFC personnel and Optronic Laboratory people to make some comparison measurements and discuss the measurement techniques involved. Design of new fixtures to position and align the calibration test equipment to improve precision has been initiated. Updating the measurement equipment to make it more computer compatible is being considered.

Our recommendation is that these calibration constants be used as GSFC's best estimates within the uncertainties noted above. The

values given for the hemisphere are considered as being more reliable than those of the 6-foot sphere since the precision of measurement for the hemisphere is somewhat higher than that for the sphere. However, the uncertainties in the absolute values of each device are probably comparable.